PINE FORD STUDY

Agenda--Public Workshops
February 10, 1982
Jefferson College, Hillsboro
February 11, 1982
Holiday Inn, Eureka

6:30 PM	Registration
7:00 PM	Opening Session Welcome, Introductory Remarks--Colonel Robert J. Dacy Tonight's Meeting Agenda Brief Study History Prior Public Involvement--Results of October, 1981 Meetings The Screening Process Small Group Sessions-- Future Activities
7:30 PM	Disperse to Small Group Sessions
7:45 PM	Small Group Sessions Presentation of Measures Clarify and Identify Additional Advantages and Disadvantages Evaluation of Measures Evaluation of Workshop Closing Comments by Group Facilitator
9:45 PM	Adjournment

HEAVY METALS REMEDIAL MEASURES

NO CORPS ACTION

This scenario relates what will most likely happen with respect to the problem of heavy metals contamination in the absence of a Corps project.

EXISTING NATURE OF PROBLEM

A study conducted for the Corps by the Columbia National Fisheries Laboratory indicates that there are high concentrations of heavy metals (lead, manganese, cadmium, barium, and others) in various aspects of the river system. High concentrations appeared in the water itself, the streambed sediment, fish and other aquatic animals, and plants such as algae and water willow. The concentrations of these metals increase dramatically downstream of the lead mining areas. High concentrations of lead were found at Brown's Ford Bridge which is nearly 40 miles downstream of the nearest lead mining area.

It is extremely difficult to estimate exactly what proportion of the river's metals are derived from mining wastes and what proportion represents background contamination from natural sources. However, it is widely assumed that much of the lead within the stream is the result of a dramatic break in the Desloge tailings pond dam in the summer of 1977. That material now appears to be working its way downstream.

It is interesting to note that the water quality itself is not alarming, with the highest concentrations of suspended metals occurring during high flow periods. It is believed that standard treatment processes would easily produce water within the Missouri Drinking Water Standards. Even as raw river water, most metal concentrations fall within the acceptable limits.

OUTLOOK FOR THE FUTURE

Given the vast amount of mining wastes (both barite and lead) which exist within the Big River watershed, it is apparent that to insure against future failures will be a massive and expensive undertaking. Current mining activities are covered by stringent dam safety and reclamation laws which will prevent a proliferation of high hazard sites. Older, often abandoned mining wastes are the real problem. It appears doubtful that, within the foreseeable future, the state of Missouri or the Counties will be able to marshal sufficient funds to address this problem. Moreover, the Federal Government's Superfund for cleanup of hazardous wastes specifically excludes primary and secondary mining activities.

The net result then appears to be a continuation of the problem as it exists today. Over a long period of time, the stream may cleanse itself by flushing the existing metals downstream. However, it appears that additional mining wastes will continue to enter the stream so long as no measures are implemented to prevent it.

REPAIR SIDE SLOPES and/or barite tiff ponds

DESCRIPTION: Rework the side slopes of the tailings piles by benching, flattening, and stabilizing the slopes with plantings. and tiff ponds

LOCATION: Lead tailings piles throughout the study area.

COSTS: Not yet determined.

COST SHARING: [redacted] undefined at this time

BENEFITS: Would keep heavy metal sediments from entering stream except for runoff.

ADVANTAGES:

- This measure would have moderate costs when compared to other available measures.
- This measure would have minimal environmental effects.

DISADVANTAGES:

- This measure is less reliable than other measures treating the same problem.
- This measure would not stop metals in surface runoff.

NATURAL FLUSHING

DESCRIPTION: Involves keeping heavy metals material in suspension and carrying them out of the Big River.

LOCATION: All along the Big River.

ADVANTAGES:

- Natural process.
- No cost.

DISADVANTAGES:

- Lengthy process.
- Must have high flow for this mechanism to be effective.
- Does not prevent environmental damage in the mean time.

These 2 are natural phenomena & are not really measures.

NATURAL SEDIMENTATION

DESCRIPTION: At low flow, the pollutants would settle out of suspension and be covered up by other materials settling out of suspension as well, thus cleansing the running water.

LOCATION: All along the Big River.

ADVANTAGES:

- Natural process.
- No cost.

DISADVANTAGES:

- A great deal of time involved.
- At high flows, the contaminant sediment could be reworked.
- This mechanism is effective only during periods of low flow.
- Aquatic life has a good chance of becoming contaminated before the pollutants are completely buried.

REROUTE RIVER TO BYPASS TAILINGS PILES

DESCRIPTION: Some tailings piles are excavated immediately against the river bank and the materials can easily erode into the stream. These areas could be bypassed by rerouting the stream to avoid the materials.

LOCATION: This measure could have application at several sites although the Desloge site, located at a "hairpin" bend in the Big River, looks most promising on a map of the area.

COSTS: Not yet determined. $(40 \times 10^6\ yd^3)$

COST SHARING: Problems of this type are unprecedented and cost sharing policies are not yet defined.

BENEFITS: By keeping more materials containing heavy metals from entering the streams, it is believed that problems downstream involving contaminated plants, fish, and wildlife can be reduced and possibly eliminated over the long term.

ADVANTAGES:

- Should be highly effective in keeping additional solid material out of the streams.

- Straight-forward construction procedures would be involved.

- Operation and maintenance costs would be low.

DISADVANTAGES:

- The measure could be very expensive if a long cut-off channel would be needed or if tunneling or a deep "open cut" through rock would be required.

- Land owners next to the "cut-off" part of the stream would seem to deserve compensation.

- Heavy metals in solution could still be carried by runoff into the streams.

SEDIMENT TRAPS

DESCRIPTION: Low dams with excavated "settling basins" could be constructed on tributary streams or on the Big River itself to trap the solid materials that contain the heavy metals.

LOCATION: Various sites are promising, particularly immediately downstream of the confluence of two or more tributaries that flow through tailings pile areas.

COSTS: Not yet determined.

COST SHARING: Cost sharing policies are not yet defined for measures dealing with such an unusual problem.

BENEFITS: This measure would either prevent heavy metals from entering the Big River or else isolate the majority of the metals to the upper reaches of the Big River.

No. metals are tied to fine partic

ADVANTAGES:

- Reduction of heavy metal contaminants going downstream.

- Moderate cost (although dependent upon the degree of water quality wanted).

DISADVANTAGES:

- Effectiveness uncertain.

- High operation and maintenance cost.

- Less protection at high flow.

STRUCTURAL CONTAINMENTS

DESCRIPTION: Placing structures around the tailings ponds and dams (containment walls, dikes, etc.) so the pollutants do not go into the river, but are diverted into settling ponds.

LOCATION: St. Joe State Park tailings dams and Deadwood tailings dam.

COST: Not yet determined.

COST SHARING: Cost sharing policies are not yet defined for measures dealing with such an unusual problem.

BENEFITS: This measure should be effective in keeping the contaminants out of both the Big River and its tributaries.

ADVANTAGES:

- Stopping the problem at the source.
- Low operation and maintenance.

DISADVANTAGES:

- Construction cost could be high.

REHANDLING/DISPOSAL OF TAILINGS

DESCRIPTION: Removing heavy metal contaminated sediment from the bottom of the river or sediment trap and placing them in an area that will not be a problem in the future.

LOCATION: Anywhere there is a danger of contaminated sediment being reworked, which could occur in a sediment trap.

ADVANTAGES:

- Lessen the danger of pollutants being reworked.
- Possible cost recovery.

DISADVANTAGES:

- Storage area scarce.
- High operation and maintenance cost.
- Fluctuating metal prices.

NO CORPS ACTION

Once again, this scenario relates to what will most likely happen in the study area with respect to water supply in the absence of a Corps project.

It appears that the vast majority of the Meramec basin and surrounding area will experience few problems with their basic water source -- groundwater. Even with projected population increases, it appears that the groundwater resource can be adequately developed to supply future needs.

The southern St. Louis Metropolitan area which includes not only southern St. Louis County but also Northern Jefferson County could experience problems. At present, this area is dependent upon deep wells, wells within the Meramec alluvium, or direct withdrawals from the Big and Meramec Rivers, with the great majority of the water coming from the latter. It appears likely that population increases within this area will generate a demand for water which the Meramec River cannot supply, at least during periods when its natural flow is low.

The result will be that the major utility within the area, the St. Louis County Water Supply Company, will have to seek other sources. Representatives of the company have indicated that in the absence of any government-furnished project, the utility would probably view a pipeline from the Missouri River as its most likely additional source. Other potential alternatives are discussed on the following pages.

WATER CONSERVATION

DESCRIPTION: Water conservation is any beneficial reduction in water use or in water losses. Water conservation is different from other forms of conservation. Energy conservation is usually thought of in terms of nonuse so that the resource will be available at a future time. Fish and wildlife conservation provides for use of that resource in a manner that preserves and protects the regenerating capability of the resource. Nonuse of water does not automatically insure its availability at a later time.

The reason for this is primarily twofold. First, the regenerating process (hydrologic cycle) is pretty much beyond our ability to manage at this time. Secondly, use of the water does not result in consumption of the water in the same manner that gasoline is consumed, that is rendered unavailable for reuse. For example, a large portion of water withdrawn from a river and then "used" is returned to the river and is available for reuse by others downstream.

Water conservation, however, is important from two standpoints: First, it is important in areas where the basic supply is simply not adequate to serve all demands at all times. Secondly, it can be important from a cost standpoint in every area because water conservation can cut down on treatment costs, distribution costs, and costs needed to heat water.

Conservation measures can be implemented in two ways: on an everyday basis or in times of drought emergencies only. Following are examples of each.

Emergency Measures.

a. Increasing the price of water during a drought.

b. Restricting certain types of usage such as lawn sprinkling or car washing during a drought.

c. Education programs to inform the public of the importance of conserving.

Everyday Measures.

a. Installing meters for every customer instead of merely charging a flat monthly rate.

b. Institution of a leak detection program.

c. Institution of a pricing policy which charges higher rates as usage rises (rather than charging a flat rate per gallon).

d. Education programs.

e. Building regulations requiring such things as pressure reduction valves and water saving plumbing fixtures.

f. Conservation kits to be distributed to homeowners including items such as shower head flow restrictors, guards to reduce quantity of toilet water flushed, and dye tablets to detect leaks.

LOCATION: In homes and businesses throughout the study area.

COSTS: Cost varies according to the measure being implemented. Some cost nothing, others cost thousands of dollars.

COST SHARING: Entire cost would be borne by non-federal interests.

BENEFITS: Benefits could include reduction in size, and hence cost, of supply facilities such as wells, pipelines and reservoirs. Cost reductions could also be achieved in such areas as treatment plant construction, water treatment and energy used to heat water.

ENVIRONMENTAL EFFECTS: Positive impacts would include the fact that more water would remain in streams for aquatic life. Negative impacts would include dying lawns, shrubs or, in some cases, even trees where certain types of lawn watering restrictions were in effect.

ADVANTAGES:

- Most measures are relatively cheap.
- Structural supply and treatment measures can be reduced in size and hence in cost.
- Large savings can be realized in reduced energy costs.

DISADVANTAGES:

- Many measures are difficult to enforce and hence are somewhat unreliable.
- Some types of emergency regulations can cause severe hardship and economic losses.
- Conservation alone could not overcome the projected shortages, hence water supply measures would still be needed.

MISSOURI RIVER PIPELINE (UNTREATED)

DESCRIPTION: A pipeline, approximately 5 miles long, could be constructed to divert water from the Missouri River to the Bourbouse River during periods of drought. The water would then flow from the Bourbouse River into the Meramec River where it would be withdrawn at existing (or future) treatment plants to serve the southern portion of the St. Louis Metropolitan area. To avoid adverse environmental impacts to the Bourbouse and Meramec Rivers, the plan would utilize settling basins to remove the heavier silt load of Missouri River waters before pumping to the Bourbouse. It is important to note that this system would be operated only during drought periods since during normal flow periods, the Meramec River can adequately serve the southern St. Louis Metropolitan area.

LOCATION: The water would be withdrawn from the Missouri River approximately 3 miles east of Washington, Missouri. It would be discharged into the Bourbouse River approximately 3 miles northeast of Union, Missouri.

COSTS: Roughly $50 million

COST SHARING: All costs, including construction, operation and maintenance, would be borne by non-Federal interests.

BENEFITS: Implementation of this measure would insure a dependable municipal and industrial water supply for southern St. Louis County and northern Jefferson County.

ADVANTAGES:

- The Missouri River would be a completely dependable source even during the worst drought on record.

- This plan could should be one of the cheapest ways of supplying water to the Greater St. Louis area during droughts.

DISADVANTAGES:

- Because the system would be used infrequently (perhaps only 5% of the time, [redacted]), it would be susceptible to deterioration and vandalism during interim periods. Unless the facility was regularly patrolled, well maintained and periodically operated (costly activities), it might not function when needed.

- This plan also raises legal questions in that water from one drainage basin would be diverted to another.

- The plan would have to be undertaken entirely by non-Federal interests.

MISSOURI RIVER PIPELINE (TREATED)

DESCRIPTION: This plan calls for withdrawing water from the Missouri River, treating that water, and then piping the water to areas in southwestern St. Louis County and northern Jefferson County where it would be needed in the future.

LOCATION: At this time it is impossible to select the best alinement for this pipeline because the exact location of future development will no doubt be the deciding factor. Future projections for development within St. Louis County (prepared by St. Louis County) and a continuance of development patterns in nothern Jefferson County indicates that a central distribution point near Glencoe, Missouri would serve to put this plan on an equal footing with other plans.

COSTS: The total cost for a pipeline of this type would be in excess of $50 million.

COST SHARING: All costs including construction, operation and maintenance would be borne by non-Federal interests.

BENEFITS: Implementation of this measure would insure a dependable municipal and industrial water supply for southwestern St. Louis County and northern Jefferson County.

ENVIRONMENT EFFECTS: There would be some losses of terretrial habitat along rural portions of the pipeline right-of-way.

ADVANTAGES:

- This alternative is preferred (after a multipurpose reservoir) by St. Louis County Water Company.
- [redacted]

DISADVANTAGES:

- Construction of a pipeline through developed areas would be extremely expensive.
- Despite the existing system, larger facilities and equipment would still be needed.
- Opportunities to address other needs of the study area would be lost if this were the only measure adopted.

SINGLE PURPOSE IRONDALE RESERVOIR

DESCRIPTION: A dam would be constructed across the Big River in Washington County southwest of Irondale, Missouri. Its sole purpose would be to impound water for release to downstream areas which would otherwise experience shortages during low flow periods.

COST: Costs could range from $50 million to $100 million.

COST SHARING: All costs would be borne by non-Federal interests.

BENEFITS: The reservoir would provide a reliable source of water for the southern St. Louis Metropolitan area.

ENVIRONMENTAL EFFECTS:

- the replacement of river fish species with lake species
- the obstruction of fish migration
- the loss of approximately 2500 acres of terrestrial habitat (mostly forest and cropland)
- the loss of archaeological resources (an extensive recovery program would lessen this)
- the increase in low flows during periods of drought should have a positive effect on both water quality and aquatic life

ADVANTAGES:

- The reservoir, in supplying water downstream, would augment low flows to the benefit of water quality and aquatic life.

- The reservoir would be smaller, less costly, and cause less damage to the environment than would a multipurpose one.

- The most popular floating and fishing reaches of the Big River would be unaffected.

DISADVANTAGES:

- Single purpose facilities are less efficient and therefore more difficult to justify economically.

MISSISSIPPI RIVER PIPELINE

DESCRIPTION: Water would be withdrawn from the Mississippi River, treated, and then pumped up the Meramec Valley to interconnect with existing or future distribution systems.

This measure would probably be utilized only during periods of low flow in the Meramec River.

LOCATION: The water intake would be near the mouth of the Meramec River and treatment facilities would be located nearby.

COSTS: Pipeline and pumping costs would be fairly comparable to other pipeline systems. Treatment costs would be considerably higher, perhaps as much as 50-100% more, because of the likelihood of chemical spills immediately upstream within the St. Louis harbor.

COST SHARING: All costs would be borne entirely by non-Federal interests.

BENEFITS: This plan should ensure a reliable source of water for the southern Metropolitan area.

ENVIRONMENTAL EFFECTS: There would be some loss of habitat and archaeological sites along the pipeline right-of-way.

ADVANTAGES:

- This measure would be very reliable in terms of quantity of water.

DISADVANTAGES:

- The most likely implementing body, the St. Louis County Water Company, does not favor this measure because of the potential for severe water quality problems (i.e. oil, chemical spills)

- Treatment for water from this source could pose severe operating problems because of the rapidity with which the water quality could change downstream of the St. Louis area.

RIVER ACCESS AREAS AND GREENBELTS

DESCRIPTION: River access areas range in size from three to ten acres, and Greenbelts are generally linear parks situated along river corridors allocated to preservation of a rivers natural environment in or near urban areas. Both are intended for recreational use by the public. Facilities generally provided usually consist of trails, picnic tables, circulation roads and parking for cars, restrooms, and boat launching ramps.

LOCATION: Potential locations abound throughout the study area. Generally, for river access areas intervals of 8-10 miles are average. The Department of Conservation has already developed 7 access points, and plans to acquire land for 6 additional. Greenbelts are generally located along segments of a river that offer outstanding natural and intrinsic environmental qualities such as scenic bluffs, rapids, rock outcroppings, and vegetation.

COSTS: Although all costs would be subject to 50-50 cost sharing with a non-Federal public entity that would agree to operate and maintain all such areas developed, it is expected that large sums of money would not be involved.

COST SHARING: To date no plans are being formulated for recreational development of Greenbelts and other non-reservoir alternatives. Inclusion of such plans requires that there be a current "letter of intent" on file whereby a local public entity has agreed to operate and maintain the recreational facilities, and to share in the costs thereof. A letter signed by the Governor of the State, or a responsible official stating this participation, is needed at this stage of planning in order to support future programming of funds for continued planning into the design stage. On-going efforts have been underway in regard to obtaining agreement with the State of Missouri on this matter. The Corps is required, under provisions of the Federal Water Project Recreation Act (PL 89-72), to maintain close and continuing coordination of planning with prospective cooperating agencies. In this regard, for all project alternatives (i.e. greenbelts, river access areas, reservoirs and flood control measures) that may involve recreational development, plans must be prepared jointly by the Corps and the cooperating non-Federal entity.

MULTIPURPOSE RESERVOIRS

DESCRIPTION: This measure involves the construction of a dam across the Big River Valley which would impound a permanent pool of water, or lake, behind it. This pool of water could be utilized for several purposes including: water supply, recreation, low flow augmentation and hydropower. In addition to some or all of these purposes, the dam would be constructed to a height that provided reserve capacity for storing high river flows (floods).

LOCATION: Although numerous sites were investigated between Morse Mill and Brown's Ford Bridge the originally authorized site at Big River Mile 43.8 (about 5 miles upstream from the Highway Y crossing) has been selected as the best. Although no definite size has been selected, the lake's normal pool could extend as far south as Washington State Park and its flood control pool could extend well into St. Francois County.

COSTS: The total costs of a multipurpose reservoir at Pine Ford could range anywhere from $120 million to $300 million, depending on which purposes are desired or justified and what size development appears to be best. Of this amount, approximately $10 million would be required for recreational development.

COST SHARING: The initial construction cost of the reservoir, including all lands and relocations, would be borne entirely by the Federal Government. However, the cost of any storage allocated for water supply or hydropower would have to be repaid by the local sponsor. All costs of operating and maintaining the reservoir would be borne by the Federal Government. Any separable facilities constructed for recreation would be cost shared 50:50 by the Federal Government and the local sponsor. The local sponsor would assume all operation and maintenance costs associated with recreation facilities.

BENEFITS: Annual flood control benefits (reduction in average yearly flood damages on the lower Big and Meramec Rivers) will depend on the size of reservoir which appears best. Preliminary analyses indicate that the damage reduction benefit could range from $1 million to over $3 million annually. The majority of this benefit will be to homes, businesses and other structures with the remainder to cropland. Potential recreation benefits resulting from a reservoir project would be approximately $3.3 million annually.

ENVIRONMENTAL IMPACTS: The more significant environmental impacts associated with this measure include:

- the replacement of river fish species with lake species
- the potential for increased lead contamination of aquatic life
- the obstruction of fish migration
- the loss of 3000 to 5000 acres of terrestrial habitat (mostly forest and cropland)
- potential for additional habitat losses due to induced development near the reservoir
- the loss of archaeological resources
- loss of foraging habitat for Indiana bat but enhancement of wintering habitat for bald eagle
- low flow augmentation during periods of draught should have a positive effect on both water quality and aquatic life

ADVANTAGES:

- Because one structure can be designed to accomplish various purposes, multipurpose projects are generally more efficient than single purpose facilities.
- Flood damages would be reduced over all downstream reaches of the Big and Meramec Rivers, not just at isolated locations.
- A multipurpose reservoir could provide a boost to the local economy.
- A multipurpose reservoir could incorporate hydropower.
- New kinds of recreation would be available close to the St. Louis Metropolitan area: powerboating, sailboating, and water skiing.
- Since the heavy metals problem would have to be remedied as a condition for constructing a multipurpose reservoir, this could offer a vehicle for Federal funding of heavy metals remedial measures.

DISADVANTAGES:

- This measure would be very expensive, both in terms of first cost and in terms of operation and maintenance costs.
- This measure requires a great deal of land.
- A reservoir could not effectively control floods caused by downstream rainfall or by Mississippi River back water.
- As noted above, some purposes require extensive local costsharing.
- A reservoir, by stimulating tourism and development, could change the rural character of the area and cause increased burdens on local government.
- A reservoir would cause significant environmental impacts.
- A certain amount of stream recreation would be lost.

FLOODPROOFING

DESCRIPTION: Protecting individual or groups of structures with small levees/floodwalls. Also, the building of new structures or raising existing structures above the projected height of flood water.

POTENTIAL LOCATIONS: This measure is most promising in areas where structures have a high probability for frequent flooding.

COSTS: The costs of such measures vary widely according to the type of structure, its size, its structural soundness and the height to which it must be floodproofed. As an example, the cost of elevating an average sized home 2 feet can equal $25,000 or more.

COST SHARING: Under present policy, the Federal government would assume 80 percent of the construction cost with the local element assuming the remaining 20 percent. All operation and maintenance costs would be a local responsibility.

BENEFITS: Damage reduction benefits would be limited to those homes or groups of homes where this measure proved economically feasible.

ADVANTAGES:

- Flood damages would be reduced.

- The protective measure used can be tailored on a case-by-case basis.

- There are usually no relocations needed, and disruption to the community is minimal.

- These measures have minimal, if any environmental impact.

DISADVANTAGES:

- This measure is usually too costly to be justified on an individual basis unless the particular structure is highly valued, such as a factory, warehouse, apartment complex, etc.

- Although the structures would be protected, they would continue to be largely inaccessible during flooding.

- Some structures and facilities, such as streets, utilities, etc. cannot be readily protected.

- There could be a great deal of disruption to existing businesses and homes while they are being raised or while the small business or floodwalls are being constructed.

PERMANENT FLOOD PLAIN EVACUATION (RELOCATIONS)

DESCRIPTION: Relocating residents, businesses, etc. out of the floodprone areas.

POTENTIAL LOCATIONS: This is primarily considered in areas with a high probability of frequent flooding.

COSTS: Major costs include land purchases, physical removal of buildings and improvements and relocation assistance for residents and businesses.

COST SHARING: The non-Federal portion is currently limited to 20% of the total project cost.

ADVANTAGES:

- Structures and residents are permanently removed from the floodprone area. In essence, the damages and danger are eliminated.

- The vacated land can be used for other purposes, such as wildlife habitat, parks, playgrounds, parking lots, etc. These could add to the aesthetics of the community.

DISADVANTAGES:

- This is an extremely costly measure and is hard to justify. The property must be purchased, the structues demolished, and the debris hauled away. The former residents must be provided with a relocation allowance to help them get established in housing which must meet certain habitability standards.

- Future development is prevented in the areas vacated. Local entities would have to maintain the property.

- Disruption in the community occurs with the removal of residents/homes and businesses.

- Some people are willing to accept the risk of flooding and would object to forced removal.

FLOOD WARNING AND TEMPORARY EVACUATION

DESCRIPTION: Establishing a system to forecast the threat of flooding and then issue warnings to residents via sirens, television, radio or a combination of these. This enables people to evacuate themselves and mobile property, thus reducing the threat to human life and some flood damage.

POTENTIAL LOCATIONS: This is primarily considered in urban areas where residents, etc. are subject to "flash" flooding. In these cases, people may not be able to recognize the danger of flooding on their own either because of the time of its occurrence or the speed with which the water rises, or both.

COSTS: The cost for a complete system, capable of giving the earliest possible warning signal to the lower Meramec and Big Rivers would cost roughly $3 million.

COST SHARING: Indefinite; Federal assistance may be available to offset the initial installation costs.

BENEFITS: The most important benefit, although not quantifiable in dollar terms, would be the system's potential for saving lives. Damage reduction benefits would result from the elevation of belongings within the home and the removal of some items such as automobiles.

ADVANTAGES:

- This is a relatively low cost measure, compared to other structural and nonstructural measures.

- Timely, that is, this gives people the opportunity to evacuate, taking portable property with them or moving it to a higher elevation before the flooding becomes severe.

- No relocations are needed and minimal disruption of existing facilities would occur.

DISADVANTAGES:

- Structures, streets, farmlands, etc. are not protected and are still susceptible to flood damage.

- Families and the communities are temporarily disrupted.

- People may not respond; malfunctions may occur, and false alarms are possible.

FLOOD PLAIN REGULATIONS

DESCRIPTION: Measures, such as zoning and building codes, taken by local governing bodies (counties, municipalities, etc.) which prevent new construction of damageable structures within the 100-year flood plain and prohibit construction that could raise the level of flooding.

POTENTIAL LOCATIONS: These can be adopted anywhere within the study area subject to flooding.

COSTS: The major costs would include administrative costs, such as establishing a Zoning Board and enforcing the measures adopted.

COST SHARING: All costs are non-Federal.

ADVANTAGES:

- The cost is minimal.

- Once in effect, the residents would be able to participate in the flood insurance program.

- Flood damage to future development would be controlled and flood damages to existing development could gradually decline in the future.

DISADVANTAGES:

- Damages to houses, buildings, etc. presently being flooded would not be reduced nor would the residents be provided with safer conditions.

- Development within the area may be limited.

- The effectiveness is dependent upon the local processes to implement and enforce. This can be hampered if many property owners do not want to be restricted as to how they can use their land.

LEVEE/FLOODWALLS

DESCRIPTION: A levee is an earth embankment with a broad base which tapers as it rises to a narrow top (usually 10 feet). Because of this taper, which is needed for stability, a levee's base width is normally six to ten times greater than its height. The sloping sides of the levee are usually planted in grass. A floodwall is simply a vertical concrete wall; the height and thickness of which is dependent upon its location and type of construction. (Pump stations are being investigated in conjunction with both measures.)

POTENTIAL LOCATIONS:

a. North Side Lower Meramec (Telegraph Road Area)
b. Arnold
c. Butler Lakes
d. Fenton
e. West Watson Road
f. Weiss Airport
g. Valley Park
h. Peerless Park
i. Times Beach
j. Eureka
k. Lower Big R. (trailer park)
l. House Springs

COSTS: The major cost items include levee/floodwall and pump station construction, right-of-way, and operation and maintenance. Depending on the location, the initial cost could range from $5 million to $40 million.

COST SHARING: Generally, the Federal Government is responsible for construction costs; the local sponsor (non-Federal) must provide all necessary right-of-way, road improvements and utility relocations, and must operate and maintain the project after it is constructed.

BENEFITS: Thousands of floodprone homes and businesses along the Meramec and Big Rivers would be rendered virtually flood-free.

FEASIBILITY: Although studies are not conclusive at this time, levees at most of the locations appear marginal at best. The most promising site appears to be Valley Park.

ADVANTAGES:

- Besides preventing flooding from heavy rainfall within the basin, levees would protect the lower Meramec River flood plain from Mississippi River backwater flooding.

- The effects of the measures are localized, that is, the measures are constructed where the problem exists rather than in another area which has no problem or would not benefit.

- Moderate environmental impacts are likely to occur.

DISADVANTAGES:

- Though more moderate in cost than some measures, levees are still hard to justify economically.

- The natural drainage can be trapped behind the levee/floodwall when the river is high and pumping stations are usually needed to discharge the water into the river. These stations are expensive to construct and to operate and maintain.

- No levee/floodwall can be designed to give 100% protection. The people who live behind these structures may develop a false sense of security.

- Both kinds of measures can cause higher river stages by constricting the flow within the natural flood plain.

- Some people may object to the obstructed view and access to the river.

SINGLE PURPOSE (DRY) RESERVOIR

DESCRIPTION: A storage area behind a dam which becomes a temporary lake after a heavy rainfall occurs upstream. By holding back the water, downstream flooding is prevented or reduced. After the danger of flooding is over the stored water is released in a controlled flow until only a small pool remains behind the dam.

POTENTIAL LOCATIONS: Although several locations were considered, only one location has been investigated, the originally authorized Pine Ford Lake dam site.

COSTS: Costs vary according to size and could range from $100 million to $250 million.

COST SHARING: The Federal Government would probably be responsible for all construction costs as well as operation and maintenance.

ADVANTAGES:

- Definite quantifiable benefits, that is they can be expressed in terms of dollars. Benefits would be realized over a wide area since flood damages could be reduced on all of the floodprone lands downstream.

- Moderate amounts of land would need to be acquired; flowage easements could be sufficient in pool areas less frequently flooded.

- The dam could be designed to trap sediments containing heavy metals, helping to restrict the problems to the areas upstream.

- Fewer road relocations or alterations would be needed than for a multipurpose reservoir.

- Cost-sharing requirements would be eliminated or greatly reduced.

DISADVANTAGES:

- Single purpose projects are usually less efficient.

- The opportunity to provide water supply, recreation, hydropower, and other benefits would be lost.

- Land acquisition could still be expensive.

- An upstream area would be flooded temporarily in order to reduce flood damages downstream.

- The project would not prevent backwater flooding from the Mississippi River nor would it alleviate flooding caused by downstream rainfall.

MULTIPURPOSE RESERVOIRS

DESCRIPTION: This measure involves the construction of a dam across the Big River Valley which would impound a permanent pool of water, or lake, behind it. This pool of water could be utilized for several purposes including: water supply, recreation, low flow augmentation and hydropower. In addition to some or all of these purposes, the dam would be constructed to store high flows caused by heavy rainfall upstream. This would reduce flood heights downstream.

LOCATION: Many sites were investigated between Morse Mill and Brown's Ford Bridge the originally authorized site at Big River Mile 43.8 (about 5 miles upstream from the Highway Y crossing) has been selected as the best. Although no definite size has been selected, the lake's normal pool could extend as far south as Washington State Park and its flood control pool could extend well into St. Francois County.

COSTS: The total costs of a multipurpose reservoir at Pine Ford could range anywhere from $120 million to $300 million, depending on which purposes are desired or justified and what size development appears to be best.

COST SHARING: The initial construction cost of the reservoir, including all lands and relocations, would be borne entirely by the Federal Government. However, the cost of any storage allocated for water supply or hydropower would have to be repaid by the local sponsor. All costs of operating and maintaining the reservoir would be borne by the Federal Government. Any separable facilities constructed for recreation would be cost shared 50:50 by the Federal Government and the local sponsor. The local sponsor would assume all operation and maintenance costs associated with recreation facilities.

BENEFITS (relating to flood control): Annual flood control benefits (reduction in average yearly flood damages on the lower Big and Meramec Rivers) will depend on the size of reservoir which appears best. Preliminary analyses indicate that the damage reduction benefit could range from $1 million to over $3 million annually. The majority of this benefit will be to homes, businesses and other structures with the remainder to cropland.

ENVIRONMENTAL IMPACTS: The more significant environmental impacts associated with this measure include:

- the replacement of river fish species with lake species
- the potential for increased lead contamination of aquatic life
- the obstruction of fish migration
- the loss of 3000 to 5000 acres of terrestrial habitat (mostly forest and cropland)
- potential for additional habitat losses due to induced development near the reservoir
- the loss of archaeological resources (an extensive recovery program would lessen this)
- loss of foraging habitat for Indiana bat but enhancement of wintering habitat for bald eagle
- low flow augmentation during periods of draught should have a positive effect on both water quality and aquatic life

ADVANTAGES:

- Because one structure can be designed to accomplish various purposes, multipurpose projects are generally more efficient than single purpose facilities.
- Flood damages would be reduced over all downstream reaches of the Big and Meramec Rivers, not just at isolated locations.
- A multipurpose reservoir could provide a boost to the local economy.
- A multipurpose reservoir could incorporate hydropower.
- New kinds of recreation would be available close to the St. Louis Metropolitan area: powerboating, sailboating, and water skiing.
- Since the heavy metals problem would have to be remedied as a condition for constructing a multipurpose reservoir, this could offer a vehicle for Federal funding of heavy metals remedial measures.

DISADVANTAGES:

- This measure would be very expensive, both in terms of first cost and in terms of operation and maintenance costs.
- This measure requires a great deal of land.
- A reservoir could not effectively control floods caused by downstream rainfall or by Mississippi River back water.
- As noted above, some purposes require extensive local costsharing.
- A reservoir, by stimulating tourism and development, could change the rural character of the area and cause increased burdens on local government.
- A reservoir would cause significant environmental impacts.
- A certain amount of stream recreation would be lost.